



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/616,606	07/14/2000	Douglas P. Hart	0050.2015-000	6151

21005 7590 05/23/2003

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.
530 VIRGINIA ROAD
P.O. BOX 9133
CONCORD, MA 01742-9133

EXAMINER

HESELTIME, RYAN J

ART UNIT	PAPER NUMBER
----------	--------------

2623

DATE MAILED: 05/23/2003

5

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/616,606

Applicant(s)

HART, DOUGLAS P.

Examiner

Ryan J Hesseltine

Art Unit

2623

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 July 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Information Disclosure Statement

1. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered (referring to page 5, line 26 to page 6, line 2).

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the aperture element comprising three optical shutters offset from the optical axis and switching means for sequentially switching on the optical shutters (claim 3) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

4. Claims 1, 2, and 5-20 are rejected under 35 U.S.C. 102(a) as being anticipated by Rohaly et al. ("High resolution, ultra fast 3-D imaging," cited on applicant's IDS as document 'AS'). Rohaly et al. clearly meet all the limitations listed in claims 1, 2, and 5-20 (see whole document).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1, 5-7, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Altschuler et al. (USPN 4,294,544), hereafter Altschuler, in view of Hart (USPN 5,850,485).

7. Altschuler discloses an imaging system and method for imaging a target in three dimensions (column 4, line 43-50), the system comprising: a light projection source for projecting a beam of light onto the target (column 4, line 63-68); an image acquisition subsystem for acquiring at least two images from light reflected by the target (column 6, line 1-12; column 10, line 16-18); and a correlation processor for processing the acquired images (column 14, line 40-45). Altschuler does not disclose that the images are processed according to a sparse array image correlation process.

8. Hart discloses a sparse array image correlation system and method wherein two images are cross-correlated using a sparse array image correlation method (column 9, line 45-58). It would have been obvious to one of ordinary skill in the art at the time the invention was made to correlate the images using sparse array image correlation as taught by Hart in order to obtain a much faster correlation result between the two images (column 8, line 15-25).

9. Regarding claim 5, Altschuler discloses that the subsystem comprises a lens, an aperture element and a camera disposed along an optical axis (inherent) and wherein the camera includes a single CCD element (column 9, line 13-25).

10. Regarding claims 6 and 9, Altschuler discloses the light projection source includes a diffuser (producing a divergent beam array) for projecting a beam of light having a random pattern (column 6, line 38-54).

11. Claims 2-4, 8, and 10-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Altschuler in view of Hart as applied to claims 1 and 7 above, and further in view of Gharib et al. (USPN 6,278,847), hereafter Gharib.

12. Regarding claims 2 and 8, Altschuler discloses that the subsystem comprises a lens, an aperture element and a camera disposed along an optical axis (inherent) and that at least two images are acquired sequentially from different angles (column 9, line 64 to column 10, line 18), but does not disclose an aperture element including an opening offset from the optical axis. Gharib discloses an aperture coded camera for three-dimensional imaging wherein the aperture element includes an opening offset from the optical axis (column 1, line 43-50) and the image acquisition subsystem further includes rotation means for rotating the aperture element about the optical axis such that the at least two images are acquired sequentially from different angles (column 3, line 56 to column 4, line 7). It would have been obvious to one of ordinary skill in the art at the time the invention was made to sequentially acquire at least two images from different angles using an aperture element including an opening offset from the optical axis as taught by Gharib in order to generate a three-dimensional model of an object using a single camera without having to move the camera (as in Altschuler, column 10, line 16-18) to different

Art Unit: 2623

image capture positions by obtaining multiple exposures at different times (column 2, line 65 to column 3, line 6).

13. Regarding claim 3, Altschuler discloses that the subsystem comprises a lens, an aperture element and a camera disposed along an optical axis (inherent), and a mechanical or electro-optic shuttering system to generate coded patterns of projected light (column 6, line 55 to column 7, line 16), but does not disclose that this shutter system can be used as the aperture element.

Gharib discloses that the aperture element comprises three optical shutters (402) offset from the optical axis and the image acquisition subsystem further includes switching means for sequentially switching on the optical shutters such that three images are acquired sequentially from different angles (figure 4; column 3, line 56 to column 4, line 7). It would have been obvious to one of ordinary skill in the art at the time the invention was made to sequentially acquire images using an aperture element comprising optical shutters as taught by Gharib in order to generate a three-dimensional model of an object using a single camera without having to move the camera (as in Altschuler, column 10, line 16-18) to different image capture positions by obtaining multiple exposures at different times.

14. Regarding claim 4, Gharib discloses that the optical shutters comprise ferroelectric liquid crystal optical shutters (column 3, line 64 to column 4, line 3).

15. Regarding claims 10 and 16, Altschuler discloses an imaging system having a lens, an aperture element and a camera disposed along an optical axis (inherent), an imaging method for imaging a target in three dimensions (column 4, line 43-50), the method comprising: projecting a beam of light onto the target (column 4, line 63-68); acquiring a first and second image at the camera from light reflected by the target through the lens (column 6, line 1-12; column 10, line

Art Unit: 2623

16-18); and processing the acquired images according to an image correlation process to resolve three dimensional components of the target (column 14, line 40-45). Altschuler does not disclose rotating the aperture element such that an opening of the aperture element offset from the optical axis is set to first and second positions.

16. Gharib discloses an aperture coded camera for three-dimensional imaging wherein the aperture element includes an opening offset from the optical axis (column 1, line 43-50) and the image acquisition subsystem further includes rotation means for rotating the aperture element about the optical axis such that the at least two images are acquired sequentially from different angles (see above discussion of claims 2 and 8).

17. Regarding claim 11, Hart discloses that the processing includes processing the acquired images according to a sparse array image correlation process (see above discussion of claims 1 and 7).

18. Regarding claims 12 and 17, Hart discloses processing of the acquired images according to a sparse array image correlation process which comprises forming first and second image arrays of pixel values from respective first and second images, each pixel value associated with one of a number of pixels, selecting pixel values in the image arrays which are beyond a pixel threshold value, and performing a correlation process on the selected pixel values comprising creating first and second sparse image arrays of the selected pixel values and their locations in the respective first and second image arrays, performing individual correlations successively between pixel entries of the first sparse image array and pixel entries of the second sparse image array within a pixel distance of each other, and cumulating the correlations in a correlation table

at respective distance entries (see above discussion of claims 1 and 7; column 5, line 63 to column 6, line 48; column 9, line 45-58).

19. Regarding claims 13 and 18, Hart discloses that the processing further includes recursive correlation (column 7, line 56 to column 8, line 14; column 9, line 45-58).

20. Regarding claims 14 and 19, Hart discloses that the correlation processor provides correlation error correction (column 6, line 49-65).

21. Regarding claims 15 and 20, Hart discloses that the correlation processor provides sub-pixel resolution processing (column 5, line 42-54).

Conclusion


22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. USPN 5,608,529 to Hori discloses an optical three-dimensional shape measuring apparatus including an apertured diaphragm w/a plurality of apertures. USPN 6,493,095 to Song et al. discloses a 3D digitizer wherein a disk including optical elements such as shutters and apertures is rotated in front of a light source. USPN 5,210,557 to Kameyama et al. discloses a camera with plural lenses for taking sequential exposures including rotating shutter discs. USPN 4,101,913 to Gallistel et al. discloses a four-up Polaroid camera including an aperture plate that is rotated to expose different shutters. USPN 5,448,360 to Wakai et al. discloses a three-dimensional image-measuring device including a liquid crystal shutter that is operated sequentially. USPN 4,199,253 to Ross discloses methods and systems for three-dimensional measurement including a laser projector and sequentially operated plural shutters.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan J Hesseltine whose telephone number is 703-306-4069. The examiner can normally be reached on Monday - Friday, 8 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on 703-308-6604. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-0377.

rjh
May 19, 2003


AMELIA M. AU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600